

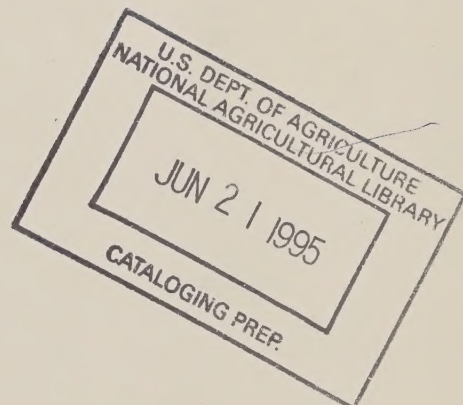
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AGRICULTURAL RESEARCH SERVICE
PLANT QUARANTINE DIVISION
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FLOWER BULB INSPECTION GUIDE



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A Reference and Guide for the Inspection
of Quarantine 37 - Regulation 3 Propagative
Material, Classified as Flower Bulbs

SECTION I

Introduction

The inspection of flower bulbs requires certain knowledge and skills not usually encountered in other phases of the journeyman inspectors duties. This paper is an attempt to gather together information involving those aspects of bulb inspection and present it in such form that it may be a readily available reference. Of necessity the material presented is far from complete, as an attempt of this nature would be so voluminous as to defeat its own purpose.

Definition of "Bulbs"

As described in Quarantine 319.37-1(h), for the purposes of Plant Quarantine, flower bulbs are: "The underground portions of plants commonly known as bulbs, corms, rhizomes, tubers, and pips and including fleshy roots or other underground fleshy growths, a unit of which produces an individual plant." There is a list of genera conforming to this definition published in the PQ Manual. These genera may also be found in Section VII of this publication. These bulbs, according to the Quarantine, may be inspected and, if found free of injurious pests, be released without further handling or treatment.

Inspection Procedures

In most cases during the inspection of a shipment of bulbs a definite percentage of each genera or variety is selected for inspection. While this procedure may have its merits, it is not altogether practical for material so diverse. Although these minimum percentages may be used as a guide line, it would be well to consider the pest risk of the particular bulb genera or variety involved as well as their area of origin when determining the extent of inspection.

It must be remembered that this material is intended for propagation. Some individual pieces may be extremely valuable. Hence, care should be taken to process the material speedily without causing unnecessary damage. Although it is often necessary to peel, prod, or cut to uncover various pests, it should be kept in mind that by so doing, the bulbs may be damaged or destroyed. Whenever possible, bulbs of high value should be handled so that nothing will detract from their ability to grow.

Care should also be taken regarding the tools used during inspection. A knife especially may transmit organisms from bulb to bulb, thereby spreading infections. Simple sanitary measures should reduce this possibility.

Soil Contamination

Being in a sense a "rootcrop," there is always the possibility that the golden nematode, Heterodera rostochiensis, or other cyst nematodes may be present. Samples of all shipments should be washed and analyzed for the presence of these pests.

If the bulbs are heavily contaminated with soil, the shipment should be held until properly cleaned. The arrangements for cleaning and necessary handling are made by the importer.

SECTION II - NEMATODES

Nearly all bulbs are attacked by one or more kinds of parasitic nematodes. Usually an attack is manifest by some type of macroscopic symptom which aids in their detection. However, laboratory examination of suspected host tissue is necessary to disclose the actual nematode.

Four genera of nematodes will be discussed here, although there are others that may infect this type of plant material. Those four genera are Ditylenchus, Aphelenchoides, Pratylenchus, and Meloidogyne.

...

In general the symptoms of infection of Ditylenchus and Aphelenchoides are similiar. These symptoms appear as a decomposition and discoloration of the cell tissue. This decayed tissue tends to be dry and granular as opposed to moist conditions associated with secondary infections by fungi such as Penicillium or Fusarium.

Depending on the bulb in question the methods used in uncovering an infection will vary. On bulbs such as Narcissus it is necessary to cut or break away the tip or neck of the bulb to expose the infection in the fleshy scales. The infection would appear as discolored concentric rings among apparently healthy scales. Most members of the family Amaryllidaceae as well as some of those in the Liliaceae and other families have this type of infection.

On corms such as Crocus in the family Iridaceae and other bulbs such as Tulipa, the infection may be seen radiating from a usually sunken basal plate. This infection may be widespread or localized into lines near the surface of the bulb or within the flesh, and the discoloration may vary from brown to charcoal gray. To see this type of infection it is necessary to first strip away the dry outer scales to uncover the fleshy part of the bulb.

Bulb material such as rhizomes, pips, tubers, and other fleshy roots may exhibit a variety of symptoms indicating nematode attack. Examples of bulbs included in this category are Dahlia, Convallaria, rhizomatous Iris, Eremurus, Bletilla, and Paeonia. There are some differences between symptoms caused by Aphelenchoides and Ditylenchus in these bulbs.

Darkened, roughened, pitted, or cracked areas on tubers or rhizomes seem to be more indicative of Ditylenchus attack.

Aphelenchoides infections tend to involve only the newly forming buds. Infections may be indicated by bud deformity or small spots or streaks of necrosis. Quite often, however, macroscopic symptoms may be obscure or lacking in these instances.

All suspected material should be macerated in water and examined with a wide-field microscope to isolate the nematodes.

A condition known as nematode wool may sometimes be seen with extremely heavy infections of Ditylenchus dipsaci. This wool is made up of masses of nematodes exiting from the bulbs. Infection may easily be spread from bulb to bulb or with the container when this occurs.

...

Pratylenchus attacks the root systems of a wide range of hosts and as such may be found on bulbous material which normally has its root system attached. Symptoms appear as small, dark, necrotic, somewhat sunken lesions on the smaller roots. The nematodes are isolated in the same way as described above.

...

The root-knot nematode, Meloidogyne, attacks its host quite differently than those nematodes already described. As its name suggests, this nematode causes the formation of knots or galls on the roots of its host. When these growths are carefully broken apart, the extremely swollen female nematodes are easily seen.

This nematode will also attack fleshy bulbs such as Caladium, Begonia, Zantedeschia (Calla), and Gladiolus. In these cases the nematode causes the formation of smooth, raised, rootless bumps or pimples on the bulb. When these bumps are sliced through, the flesh will be somewhat soft and have a watery appearance. Careful slicing and observing with a hand lens or microscope will disclose the pearly-white nemas imbedded in the tissue.

In the more advanced cases of Meloidogyne infection, the symptom may appear more as a cancerous eruption. This will eventually lead to a complete breakdown due to secondary organisms. Conditions such as these, due to culling, are rarely seen on bulbs in shipment.

SECTION III - DISEASES

This section will be devoted to those plant diseases which may affect several different hosts. A general description of these diseases will be given here.

Most of the bacteria and fungi causing these diseases are cosmopolitan in nature and usually associated with conditions of transit and storage or bulb injuries. Some of them cause common field diseases. In general, these organisms do not come under the scope of Plant Quarantine regulations. However, if the percentage of infection is heavy enough, some action may be taken in accordance with M319.37-3d. This provision states that more than 8 per cent infection of these common diseases or any appreciable amount of freezing, heating, or physical injury should be reported to the importer or broker handling the shipment. He should also be informed of the state regulations concerning such material and thus be afforded an opportunity to refuse or recondition the entry.

The following is a list of organisms causing these common diseases and the symptoms and signs which help to identify them:

...

Aspergillus spp. - Imperfect fungus

A very common secondary fungus affecting a wide range of hosts. In some instances the massing of the black spores beneath a bulb scale may be mistaken for a smut disease.

...

Botrytis spp. - Imperfect fungus

In its early stages infection may be diagnosed by the presence of "grey mold." However, when dry bulb inspection is made, this sign has usually disappeared, and infection may more easily be determined by the presence of characteristic necrotic lesions or areas. Small to large, irregular sclerotia may be imbedded in the lesions or within the scales affected with necrosis.

On Gladiolus, other Iridaceae, and Tulipa, sunken lesions of a yellow to reddish brown color may be seen. These lesions are often cracked in the center and may have small black sclerotia present. A condition in Gladiolus where the basal area becomes infected with the disease

progressing into the core, is called "core rot" and is attributed to infection by Botrytis.

...

Corynebacterium fasciens - Bacterium

The disease is best recognized by the numerous fasciated growths near the crown of the bulb or, as in the case of some corms such as Gladiolus, on the perimeter of the bulb just above the basal plate.

...

Cylindrocarpon radicicola - Imperfect Fungus

Although regarded as a secondary invader, this fungus will quickly infect the entire bulb and spread to others near it. At first the disease is difficult to detect. The bulb will look normal, except for a slight softness and possibly a faint depression accompanied by a darkening of the bulb surface. In later stages some shrinking of the bulb may be seen. When an infected bulb is cut through, the flesh will have a rusty to reddish-brown color.

...

Erwinia spp. - Bacterium

Characterized by a soft, watery breakdown of bulb tissue, the disease may progress through the entire bulb or be restricted to a small area. The infection is nearly always accompanied by a strong offensive odor.

...

Fusarium spp. - Imperfect Fungus

One of the most destructive of bulb disease organisms, it can quickly spread from bulb to bulb causing heavy losses. The presence of white to pinkish white mycelium is indicative as well as a characteristic sour odor. Further symptoms seem to differ as to the bulb genera attacked.

On Narcissus and its relatives the organism causes a condition called "basal rot." Starting at the basal plate the rot extends upwards into the bulb, coloring the fleshy scales grayish brown to dark chocolate brown. On those members of the Iridaceae affected, of which Gladiolus is a prime example, the fungus attacks the corms causing reddish-brown circular lesions with raised, irregular, concentric rings, and definite, raised margins.

Fusarium is perhaps most destructive in its attack on Tulipa. Infected bulbs are at first soft and wet, rapidly changing to a moist, decomposed state, and finally becoming dried and mummified. The color of infected bulbs ranges from light tan to light gray. A very strong sour odor during the early decomposing state has earned this condition the designation "tulip sours." A marked varietal susceptibility has been noted.

...

Macrophomina phaeseolina - Imperfect Fungus

This organism causes rotting of the bulb tissue involving one or more of the outer scales and usually the whole bulb. Small to medium sized sclerotia are formed and are found imbedded in the dried out, deteriorated tissue.

...

Papulaspora spp. - Imperfect Fungus

A bulb rot which, due to the masses of tiny sclerotia-like bodies that form and collect under the bulb scales, is quite often mistaken for a smut disease. For this reason the condition is often referred to as "false smut."

...

Penicillium spp. - Imperfect Fungus

Infection by this organism is easily recognized by its blue mycelial growth. Its cause is usually the result of poor curing or storage conditions. This fungus may be found on the outer scales or in the tip of the bulb where the leaves have died back and become infected.

Penicillium gladioli causes a condition commonly called "storage rot" on Gladiolus and other Iridaceae. Given the right conditions this disease rapidly spreads. Bulbs are completely or partially broken down leaving dry, brown shrunken portions or entire mummified bulbs. Quite often small, round yellow sclerotia will be seen.

...

Pseudomonas marginata - Bacterium

To observe the symptoms of the disease, commonly called gladiolus scab, the dry outer bulb scales must be removed. Bacterial infection causes the formation of round, sunken, shiny mahogany-brown lesions which penetrate into the flesh of the bulb. These lesions,

which have raised margins, consist of a hardened, gum-like material which can easily be picked out with the point of a knife.

...

Rhizoctonia spp. - Imperfect Fungus

A soil-borne organism producing a large amount of thick mycelium that completely envelopes the bulbs and soil around it. The mycelium, curiously branching only at right angles, can be found between the scales of the bulb. The fungus carries over from year to year by forming large dull brown to black sclerotia which usually remain in the soil. These sclerotia differ from those produced by other organisms in that their interiors are an off-white color.

There are two species that have been recorded as infecting bulbs. R. tuliparum has white mycelium and the interior of the sclerotia are yellow brown in color. R. violaceae, as its name suggests, is tinted violet.

...

Septoria gladioli - Imperfect Fungus

The disease is called "hard rot" and may be observed on Gladiolus and other corms. The fungus causes necrosis of the bulb, forming lesions of a brown to reddish brown color. These lesions are somewhat sunken with a definite margin and a distinctive wrinkled or rippled appearance on their surface. In some instances pycnidia may be observed imbedded in the necrotic areas.

...

Sclerotinia spp. - Ascomycete

This organism causes a soft, moist breakdown of tissue, covering its host with a felt of white mycelium. Large, slightly irregular, flattened black sclerotia are produced on this mycelial felt in the latter stages of attack.

...

Sclerotium spp. - Imperfect Fungus

The usual indication of the disease is the presence of small black sclerotia adhering to the outer scales of its host. This condition has been commonly called "flyspeck" and "scale speck."

...

Stagonospora curtesii - Imperfect Fungus

Somewhat rounded, elongate, brown to reddish brown necrotic areas on the outer scales of the bulb indicate the presence of this fungus. In some instances this necrosis may become rather extensive. On certain bulbs such as Amaryllis presented for inspection at a time when the first leaves are emerging, a scorching or discoloration of these leaf tips is a symptom of Stagonospora infection. Fruiting bodies (pycnidia) may sometimes be observed on infected areas.

...

Stromatinia gladioli - Ascomycete

Small, rounded blackish lesions on the corms, seen mostly along the medial lines where the scales attach, indicate infection. Sclerotia may be found both on the lesions and scales. The dry outer scales are usually stained and brittle.

...

Thielaviopsis basicola - Imperfect Fungus

This is generally regarded as a secondary invader which attacks the bulb through mechanical injuries. Blackish fungal growth on the surface of the bulb, with brownish decomposition beneath, is indicative.

SECTION IV - INSECTS

This section will deal with those few insects that, because of their host range or other similarity, can be described in general terms. Further reference to other insects will be found under specific plant genera in Section VI.

Aphids - Homoptera

Certain genera of aphids such as Anuraphis tulipae may be found associated with a wide variety of flower bulbs. They can generally be found underneath the outer scales either gathered about the growing bud or on the fleshy part of the bulb. Most of them are thought to be storage pests not able to exist under field conditions, and, as such, are not considered to be significant pests. However, any interceptions concerning aphids should be considered as quarantine important and handled accordingly.

Bulb Flies - Diptera

There are two particular insects included in this group. They each belong to the same family and affect the bulbs similarly. These are the narcissus bulb fly, Merodon equestris, and the lesser bulb fly, Eumerus tuberculatus. Some references also designate Eumerus strigatus as a lesser bulb fly as there is little difference in its means of attack and host range. All of these insects are considered cosmopolitan and not of quarantine importance. Infestations heavy enough to affect the total quality of the shipment should be handled similarly to the provisions for common diseases as described in Section III.

Eggs are laid on the stem or leaves near the soil level. Upon hatching, the larvae migrate to the bulb either by moving directly into the core of the bulb and feeding downwards or by following the outside of the bulb through the soil, entering at the basal area, and then feeding upwards. The narcissus bulb fly differs from the lesser bulb fly in that there is usually only one larva infesting the bulb. In lesser bulb fly infections it is not unusual to find four to six or more larvae in a bulb.

In the early stages of attack detection is quite difficult. The only symptom may be the scar, a slightly depressed dark brown area revealed by lightly scraping the basal plate where the larva made its entry. Further cutting or probing is necessary to reveal the larva. As the infection progresses, the bulb is hollowed out, becomes soft, and is often affected by secondary organisms causing rot.

Mealy bugs - Homoptera

These soft scale insects may be found on several different bulbs. They seek protection and may be found under the outer scales or in the cleavage where a bulblet is being formed. A powdery or waxy residue is quite often a tip-off to their presence.

Thrips - Thysanoptera

Thrips are very small insects that may be found on a variety of bulbs. Some of them are host specific while others may be general feeders. Some are considered quite important as their occurrence is not known in this country. Both larvae and adults may be found on dry bulbs.

These insects desire shelter and have an aversion to light, so some amount of probing is necessary to uncover them. In most cases inspection might be better based on the symptom produced by their feeding rather than for the insect itself. This symptom is a russeting or discoloration of the bulb's fleshy surface. Often this is associated with a slight corkiness of this tissue.

To observe the thrips or the effects of its feeding it is necessary to remove the dry outer scales and uncover the fleshy surface. On lily bulbs the bulb scales must be opened up or broken apart. If conditions permit, the bulbs may be shaken out over a clean piece of paper and the resulting debris searched for the presence of the insect.

SECTION V - MITES

Mites are found commonly throughout nature and as such will be found to some extent on most bulb material. These mites may be phytophagous, saprophytic, or predatory. We are concerned, of course, primarily with phytophagous mites as they are primary parasites of plants. These mites are discussed by name either in this section or under specific hosts in Section VI. Predatory mites, generally recognized by their ability to move rapidly about, have no quarantine importance and can be discounted. The saprophytes, however, do have some significance in that they are considered as secondary parasites and warrant further discussion.

Although there are various genera and species represented in this saprophytic group, the one most commonly encountered is the well known "bulb mite," Rhizoglyphus echinopus (F. and M.). This mite is easily recognized by its large size, pearly white color, and slow moving habits. It has two prominent opaque spots on its back which are visible with a hand lens.

These mites are considered to be primarily storage pests rather than field pests. They tend to hasten the decay of bulbs with mechanical injury or affected by disease. Their feeding in these decaying areas creates conditions suitable to the spread of disease. The mite itself can be credited directly with this spread since it may carry the disease organisms on its body.

As a group these mites are cosmopolitan in distribution and are therefore beyond the scope of Plant Quarantine. However, if heavy infestations are encountered, it would be well to make note of it on your inspection report.

...

Aceria tulipae - Eriophyidae

This is a tiny clear white mite that attacks a number of different bulbs, feeding upon their fleshy surfaces. The effect of this feeding causes a drying of the bulb surface usually accompanied by some type of discoloration. On tulip, when the outer husk is removed, the surface of the bulb will have a reddish cast. Under close examination with a hand lens or microscope you can see the mites moving about the surface. Ornithogalum mites have been found feeding in the central core of bulbs from the neck nearly to the basal plate. The symptoms here were similar to those produced by Steneotarsonemus laticeps.

...

Steneotarsonemus laticeps - Tarsonemidae

An important pest on some genera of bulbs, this mite is probably better known by its descriptive common name "bulb scale mite." The mites are quite small, somewhat elongate, and colored white in younger stages and gradually darkening to a light brown as they mature.

The mites are found in protected areas, such as under the dry outer scales, in the crevices formed by bulblets, or in the tiny air spaces in the core of the bulb, where both a food surface and shelter are available. Infestations are easily recognized by the discoloration of the bulb surface caused by the feeding mites. Depending on the extent of the infestation either patchy or extensive areas colored yellowish to light brown may be seen. The mites can be observed crawling on these surfaces with the aid of a hand lens or microscope.

Inspection for this mite can be performed simultaneously with nematode inspection where the upper part of the neck of the bulb is cut off. Discolored spots or streaks on this cut surface may indicate an infestation, which may be further disclosed by cutting the bulb through. When the center scales are lifted away, the discoloration may be seen to extend down into the bulb following the outer edges of these scales.

Another means of uncovering the mite is to peel away the outer papery bulb scales, especially near the basal area, looking for signs of mite activity. This latter method is more feasible where expensive varieties are concerned or where the bulbs have begun to sprout as there is less damage done to the bulbs.

Tarsonemid Mites - Tarsonemidae

There have been instances when other tarsonemid mites other than Steneotarsonemus laticeps have been intercepted on dry bulbs such as Begonia and Cyclamen. Among these are Hemitarsonemus latus and Steneotarsonemus pallidus. Both of these mites are primarily leaf feeders. They are found on the bulbs in very few numbers gathered under the cover of old leaf scars or sheltered by the outer scales of the emerging buds. In general they resemble S. laticeps in size, shape, and color.

SECTION VI

The purpose of this section is to provide a general listing of the various insects, diseases, nematodes, and mites under the bulb genera which they affect. These bulb genera in turn are grouped according to their family. All of the genera in Regulation 3 are not included in this section. In this respect the inspector is urged to review the other genera listed under the family involved basing his inspection on this information.

A description of the pests and procedure of inspection is given where applicable. In some instances this is included in this section; in others you are referred to Section II, III, IV, and V. The asterisk (*) refers to those pests of at least some quarantine significance, with PQ action usually taken when intercepted.

Amaryllidaceae

Alstroemeria:

Penicillium sp. - Imperfect Fungus
See Section III

Amaryllis:

*Ditylenchus dipsaci - Nematode
See Section II

Stagonospora curtesii - Imperfect Fungus
See Section III

*Mealybugs - Homoptera

Bulb Flies - Diptera
See Section IV

*Steneotarsonemus laticeps - Mite
See Section V

General Note: It is indicative that any injury to an Amaryllis bulb tends to cause a reddish color to the tissue. This should be kept in mind during the examination, since injury due to temperature extremes or mechanical injury may produce symptoms similar to some of the items mentioned.

Cyrtanthus:

*Brachycerus sp. - Coleoptera

A curculionid pest which may sometimes be found in the bulb. Holes in the bulb, softness of the

bulb, or frass adhering, may indicate presence of this insect.

Galanthus:

- *Aphelenchoides sp. - Nematode
 - *Ditylenchus dipsaci - Nematode
- See Section II

Botrytis galanthina - Imperfect Fungus
Macrophomina phaseolina - Imperfect Fungus
Sclerotium spp. - Imperfect Fungus
Stagonospora curtesii - Imperfect Fungus

See Section III

Bulb Flies - Diptera

- *Mealybug - Homoptera
- See Section IV

Hymenocallis:

- *Ditylenchus dipsaci - Nematode
- See Section II

Ismene:

Fusarium oxysporum - Imperfect Fungus
Stagonospora curtesii - Imperfect Fungus

See Section III

Bulb Flies - Diptera

See Section IV

Leucojum:

Aspergillus niger - Imperfect Fungus
Fusarium oxysporum - Imperfect Fungus
Macrophomina phaseolina - Imperfect Fungus

See Section III

Ceratocystis narcissi - Ascomycete
 Tiny, long-beaked fruiting bodies (perithecia) either on or slightly imbedded in the outer scales of the bulb indicate the presence of this disease.

Bulb Flies - Diptera

See Section IV

Lycoris:

- *Aphelenchoides sp. - Nematode
- See Section II

Sclerotium spp. - Imperfect Fungus
See Section III

Bulb Flies - Diptera
See Section IV

*Hepialus spp. - Lepidoptera
Larvae may sometimes be found feeding in these bulbs.

*Hyotanzo sp. - Coleoptera
P.C. records show interceptions of this adult weevil as being found in the bulb.

*Taeniothrips euchari - Thysanoptera
Most interceptions are from Japan.
See Section IV. (Thrips)

*Steneotarsonemus laticeps - Mite
See Section V

Narcissus:

*Aphelenchoides subtenuis - Nematode

*Ditylenchus dipsaci - Nematode
See Section II

Botrytis narcissicola - Imperfect Fungus
See Section III

Ceratocystis narcissi - Ascomycete
Tiny, long-beaked fruiting bodies (perithecia) either on or slightly imbedded in the outer scales of the bulb indicate the presence of this disease.

Sclerotinia bulborum - Ascomycete
Sclerotium spp. - Imperfect Fungus
See Section III

Bulb Flies - Diptera

*Taeniothrips euchari - Thysanoptera
See Section IV (Thrips)

*Exosoma sp. - Coleoptera
P.C. records show this pest as being intercepted with these bulbs. It belongs to the family Chrysomelidae.

*Steneotarsonemus laticeps - Mite
See Section V

Nerine:

Fusarium moniliforme - Imperfect Fungus
See Section III

*Mealybug - Homoptera
See Section

Pancraticum:

*Brachycerus sp. - Coleoptera
Interceptions of this weevil have been reported
from Turkey.

Polianthes:

Ditylenchus dipsaci - Nematode
Meloidogyne spp. - Nematode
See Section II

*Taeniothrips spp. - Thysanoptera
See Section IV (Thrips)

Sprekelia:

*Ditylenchus dipsaci - Nematode

*Steneotarsonemus laticeps - Mite
See Section V

Sternbergia:

*Ditylenchus dipsaci - Nematode
See Section II

Bulb Flies - Diptera
See Section IV

Vallota:

*Thrips - Thysanoptera
See Section IV

*Steneotarsonemus laticeps - Mite
See Section V

Zephyranthes:

*Ditylenchus dipsaci - Nematode
See Section II

Stagonospora curtesii - Imperfect Fungus
See Section III

Araceae

Arum:

Erwinia aroidea - Bacterium
See Section III

Macrophomina phaseolina - Imperfect Fungus
See Section III

*Brachycerus sp. - Coleoptera

Both adults and larvae of these weevils may be found within these bulbs. Look for bulbs soft to the touch (in some cases completely hollowed out) or with quantities of frass adhering.

*Sp. of Chloropidae - Diptera

Larvae may be found burrowing just beneath the skin of the tuber. Close observation will reveal a slight shriveling of the skin making "trails" around the bulb. Intercepted from Turkey.

Caladium:

*Meloidogyne spp. - Nematode
See Section II

Thomsonia:

*Meloidogyne spp. - Nematode
See Section II

Zantedeschia:

*Meloidogyne spp. - Nematode
See Section II

Begoniaceae

Begonia:

Meloidogyne spp. - Nematode
See Section II

Cylindrocarpon radicicola - Imperfect Fungus

Sclerotinia denigricans - Ascomycete

Papulospora spp. - Imperfect Fungus

Thielaviopsis basicola - Imperfect Fungus

See Section III

*Agriotes spp. - Coleoptera

Larvae of these pest called wireworms bore into and through these bulbs. Small holes observed on the bulbs are signs of their activity.

*Brachyrhinus sp. - Coleoptera

P.Q. records show that this member of the Curculionidae family has been intercepted from Belgium.

*Spp. of Tarsonemidae - Mite

See Section V

Bignoniaceae

Incarvillea:

Corynebacterium fascians - Bacterium

Cylindrocarpon radicicola - Imperfect Fungus

See Section III

Phytophthora cactorum - Phycomycete

The cause of a condition called "black rot." Affected tubers become soft, watery, and black in color in varying degrees.

Cannaceae

Canna:

*Meloidogyne spp. - Nematode

See Section II

Compositae

Dahlia:

*Aphelenchoides subtenuis - Nematode

*Ditylenchus destructor - Nematode

*Meloidogyne spp. - Nematode

See Section II

Agrobacterium tumefaciens - Bacterium

Causes abnormal growths, ranging from small pimples to large tumors usually near the crown of the bulb. These eruptions are quite bare of roots and have a smooth epidermis. The disease is known as crown gall.

Corynebacterium fasciens - Bacterium

Cylindrocarpon radicicola - Imperfect Fungus

Erwinia spp. - Bacterium

See Section III

Phoma solanicola - Imperfect Fungus

This fungus usually causes necrosis varying from spots to larger areas. Fruiting bodies (pycnidia) will be found slightly imbedded in these areas.

Sclerotinia sclerotiorum - Ascomycete

See Section III

*Brachyrhinus sp. - Coleoptera

A weevil which has been reported as being intercepted with these bulbs.

*Ceutorhynchus sp. - Coleoptera

A curculionid pest whose larvae cause small lumps to form on the surface of their hosts. By carefully excising these protrusions, one will find the smallish white larvae imbedded within.

*Hepialus humuli - Lepidoptera

In some instances the larvae may be found feeding within or on the bulb.

*Mealybug - Homoptera

See Section IV

Liatris:

These bulbs are no longer included on the list subject to regulations under 319.37-3. Shipments are now being sent to the nearest inspection house for handling under Regulation 319.37-6.

*Hepialus sp. - Lepidoptera

Larvae of this pest have been intercepted in these bulbs. Infestations are extremely difficult to see in that external symptoms are lacking.

Fumariaceae

Dicentra:*Meloidogyne spp. - Nematode

See Section II

Gesneriaceae

Achimenes:*Meloidogyne spp. - Nematode

See Section II

Gesneria:*Meloidogyne spp. - Nematode

See Section II

Kohleria:*Meloidogyne spp. - Nematode

See Section II

Naegelia:

- *Meloidogyne spp. - Nematode
See Section II

Rechsteineria:

- *Meloidogyne spp. - Nematode
See Section II

Sinningia: (Gloxinia)

- *Aphelenchoides sp. - Nematode
*Meloidogyne sp. - Nematode
See Section II

Cylindrocarpon radicicola - Imperfect Fungus
See Section III

Phytophthora sp. - Phycomycete
A soil organism which may sometimes infect these bulbs. A hollow bulb center is attributed to infection by this organism..

Thielaviopsis basicola - Imperfect Fungus
See Section III

- *Agriotes spp. - Coleoptera
At times these wireworm larvae may be found infesting these bulbs. Small holes in the bulb are the usual symptom of their activity.

Iridaceae

Acidanthera:

- Botrytis gladiolorum - Imperfect Fungus
Fusarium spp. - Imperfect Fungus
Papulaspora spp. - Imperfect Fungus
Penicillium gladioli - Imperfect Fungus
Pseudomonas marginata - Imperfect Fungus
Sclerotinia gladioli - Ascomycete
See Section III

Aphids - Homoptera
See Section IV

Anomatheca:

- Botrytis spp. - Imperfect Fungus
Fusarium spp. Imperfect Fungus
Stromatinia gladioli - Ascomycete
See Section III

Crocus:

- *Ditylenchus destructor - Nematode

*Aphelenchoides subtenuis - Nematode

It is interesting to note that the type of nematode infecting a bulb can often be identified on the basis of symptoms. Aphelenchoides subtenuis infections can be observed spreading or radiating outwards from the basal plate. Ditylenchus destructor infections differ by extending upwards into the central core of the bulb. These infected areas appear as dark gray streaks beneath the bulb surface. For further information see Section II.

Botrytis spp. - Imperfect Fungus

Fusarium spp. - Imperfect Fungus

Penicillium gladioli - Imperfect Fungus

Pseudomonas marginata - Bacterium

Sclerotium tuliparum - Imperfect Fungus

Septoria gladioli - Imperfect Fungus

Stromatinia gladioli - Ascomycete

Rhizoctonia violaceae - Imperfect Fungus

See Section III

*Uromyces croci - Basidiomycete

This organism, the cause of crocus rust, is very difficult to detect. The sori, in most cases, are found on the outer scales of the bulb. Due to the small size of the sori and the cleaning and processing of these bulbs for market, these signs may be broken up or obliterated.

Until the eye becomes trained to see these sori or their remnants, inspection may be accomplished by looking for the symptom on the fleshy portion of the bulb. This may be observed by first peeling off the outer scales, taking care not to lose them. The symptom would appear as an irregular brown blotch penetrating into the bulb. When found, the outer scales should be checked with a hand lens or microscope for the presence of either the sori or any loose orange-colored telia spores which may be adhering to the netting of the scale.

Aphids - Homoptera

*Mealybugs - Homoptera

See Section IV

Crocoshmia:

Botrytis spp. - Imperfect Fungus
See Section III

Freesia:

*Meloidogyne spp. - Nematode
See Section II

Botrytis spp. - Imperfect Fungus
Fusarium spp. - Imperfect Fungus
Penicillium spp. - Imperfect Fungus
Septoria gladioli - Imperfect Fungus
Stromotinia gladioli - Ascomycete
See Section III

Cucumber Mosaic - Virus

This virus disease may be recognized by the presence of black streaks on the fleshy part of the bulb. Its appearance may be somewhat similar to a heavy infection of Fusarium.

Gladiolus:

Note: Gladiolus is prohibited entry from Africa because of the presence of several rust diseases not known to occur in this country.

*Aphelenchoides sp. - Nematode
*Ditylenchus destructor - Nematode
See Section II

*Meloidogyne spp. - Nematode
External symptoms, if present, will appear as raised areas around the basal plate. In some cases the nematode may be present without causing the swelling typical of its infection. Where practical, large quantities offered, etc., transverse sections of the bulb may be made. For further information see Section II.

Botrytis gladiolorum - Imperfect Fungus
Botrytis sp. - Imperfect Fungus

Corynebacterium fasciens - Bacterium

Cylindrocarpon radicicola - Imperfect Fungus
See Section III

Curvularia lunata - Imperfect Fungus
This organism is usually seen causing a

spotting of flowers and foliage, but may sometimes be found affecting the corms. Brown necrotic areas overgrown with simple dark conidiophores bearing whorls or clusters of dark spores may indicate attack by this fungus.

Fusarium oxysporum f. gladioli - Imperfect Fungus

Papulospora spp. - Imperfect Fungus

Penicillium gladioli - Imperfect Fungus

Pseudomonas marginata - Bacterium

Rhizoctonia violaceae - Imperfect Fungus

Sclerotium spp. - Imperfect Fungus

Septoria gladioli - Imperfect Fungus

Stromatinia gladioli - Ascomycete

See Section III

*Urocystis gladiolicola - Basidiomycete

The disease, gladiolus smut, is caused by this organism. It is distinguished by the presence of its charcoal-gray smut sori which may be found on the scales or in the bulb. All species and varieties are regarded as susceptible, but this susceptibility varies considerably. The species G. nanus and G. grandis are regarded as highly susceptible.

It is interesting to note that the location of sori on the aforementioned species will differ. On G. nanus the sori will be found at or near the line running around the bulb where the scales are attached. On G. grandis the sori are found in the basal area.

The outer scales have to be peeled to see the sign on the bulb. The sori appear as charcoal gray areas beneath the surface of the bulb. In some instances these sori may be so imbedded as to be not visible by surface examination. Transverse cutting, where practicable, would be necessary in this instance for identification.

*Taeniothrips simplex - Thysanoptera

May be found feeding on the corms during storage. See Section IV (Thrips) for further information.

Aphids - Homoptera

See Section IV

Iris: (Bulbous)*Ditylenchus destructor - Nematode

In addition to the typical charcoal-gray streaks or lines of infection extending upwards from the basal plate, there are other symptoms that may be used to detect infestations. Before the outer scales are stripped away, look for bulbs with an eroded appearance where the bulb and its basal area are attached, or a discoloration of the outer scales in this same area, as these may be signs of nematode activity. Small discolored spots in the flesh of the basal plate when it is severed or discoloration at the tip of the bulb may also indicate nematode injury.

Most all of the species of bulbous iris are susceptible to nematode attack. There may be some varietal susceptibility as with the Dutch iris where the blue, white, and copper colored varieties seem more prone to nematode attack. For further information see Section II.

Fusarium sp. - Imperfect Fungus

In some instances early infections may be confused with nematode injury due to the similarity of discoloration of the bulb flesh. For further information see Section III.

Macrophomina phaseolina - Imperfect Fungus

See Section III

Mystrosporium adustum - Imperfect Fungus

A condition very commonly seen on Iris reticulata called "inkspot." As the name suggests, the disease is recognized by the dark colored blotching on the outer scales. In heavier infections the fleshy scales may be somewhat corroded and blackened.

Sclerotium spp. - Imperfect Fungus

See Section III

Aphids - Homoptera

See Section IV

*Dyspessa sp. - Lepidoptera

This pest was intercepted from Turkey in one of the species of bulbous iris.

*Mealybugs - Homoptera

See Section IV

Spp. of Phycitidae - Lepidoptera

Quite often these cosmopolitan storage insects may be found in these bulbs. They are of no quarantine significance.

*Taeniothrips simplex - Thysanoptera

See Section IV (Thrips)

Iris: (Rhizomatous)

*Aphelenchoides sp. - Nematode

*Meloidogyne sp. - Nematode

See Section II

*Leptosphaeria heterospora - Ascomycete

Small black fruiting bodies (perithecia) which may be found on the older sections of the rhizomes would indicate the presence of this fungus. If found, the entire rhizome should be presented to the specialist as well as some information pertaining to the percentage of infection in the shipment.

*Bregmatothrips iridis - Thysanoptera

This thrips seems to be associated primarily with Japanese iris. It may be found sheltered between the old leaves and the leaf buds. The thrips varies in color from white in the younger stages to brown as they become older. See Section IV (Thrips) for further information.

Ixia:

Fusarium oxysporum - Imperfect Fungus

Macrophomina phaseolina - Imperfect Fungus

Sclerotium gladioli - Imperfect Fungus

See Section III

Sparaxis:

Pseudomonas marginata - Bacterium

See Section III

Tigridia:

*Ditylenchus destructor - Nematode

*Aphelenchoides sp. - Nematode

See Section II

Botrytis sp. - Imperfect Fungus

Penicillium gladioli - Imperfect fungus

See Section III

Aphids - Homoptera

See Section IV

Tritonia: (Montbretia)

- *Aphelenchoides sp. - Nematode
See Section II

Botrytis sp. - Imperfect Fungus
Penicillium gladioli - Imperfect Fungus

Pseudomonas marginata - Bacterium

Sclerotium spp. - Imperfect Fungus
See Section III

Watsonia:

Penicillium gladioli - Imperfect Fungus

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Liliaceae

Agapanthus:

- *Meloidogyne sp. - Nematode
See Section II

*Agriotes spp. - Coleoptera
Larvae may sometimes be found in these bulbs.
Their presence is usually indicated by small
holes in the bulb.

*Haplothrips gowdeyi - Thysanoptera
See Section IV (Thrips)

Allium:

- *Aphelenchoides subtenuis - Nematode
*Ditylenchus dipsaci - Nematode
The effect of nematode infection in these
bulbs differs from the usual symptoms. In the
early stages of infection the bulb tissue
tends to swell or blister without any dis-
coloration or apparent tissue breakdown.
This condition is referred to as "nematode
bloat." As the infection progresses dis-
coloration and decomposition become more
noticeable. See Section II for further information.

Aspergillus sp. - Imperfect Fungus

Erwinia spp. - Bacterium

Papulaspora spp. - Imperfect Fungus
Penicillium sp. - Imperfect Fungus
See Section III

Sclerotium cepivorum - Imperfect Fungus

This organism causes the disease known as "white rot." It is recognized by a somewhat moist decomposition with white mycelium. Decomposition is usually complete resulting in a mummified shell of either the whole bulb or one of its segments. Inside this mummy numerous white sclerotia, somewhat resembling insect frass, will be found.

*Brachycerus sp. - Coleoptera

When handling or rolling the bulbs, break open those which seem soft or dent easily. The larvae or pupae of this weevil may be found inside. Quite often the entire bulb has been hollowed out leaving only the shell.

Hylemya antiqua - Diptera

The maggot stage of this insect has been known to attack these bulbs.

Plodia interpunctella - Lepidoptera

This is one of the cosmopolitan Phycitids that may be found from time to time in these bulbs. These general feeders are considered primarily as storage pests.

*Aceria tulipae - Mite

See Section V

*Phytoptipalpus sp. - Mite

This pest has been found several times recently on ornamental Allium bulbs from Turkey. To find it you must peel off the outer scale (especially those that have been cracked) and look for the bright orange masses of mites underneath.

Bessera:*Aphelenchoides ritzema-bosi - Nematode

See Section II

Brodiaea:Sclerotinia bulborum - AscomyceteSclerotium tuliparum - Imperfect Fungus

See Section II

Bulbocodium:*Aphelenchoides subtenuis - Nematode

*Ditylenchus destructor - Nematode
See Colchicum

*Uromyces colchici - Basidiomycete
See Colchicum

*Urocystis colchici - Basidiomycete
See Colchicum

Camassia:

Sclerotium tuliparum - Imperfect Fungus

Chionodoxa:

*Aphelenchoides sp. - Nematode

*Ditylenchus dipsaci - Nematode
See Section II

Sclerotinia bulborum - Ascomycete
See Section III

Aphids - Homoptera

Mealybugs - Homoptera
See Section IV

Colchicum:

*Aphelenchoides subtenuis - Nematode

*Ditylenchus destructor - Nematode

The following procedure is useful in seeking symptoms of nemas in this bulb. Prick the basal plate of the bulb with the point of a knife. If the bulb is healthy there will be resistance and the knife will not easily be inserted. The flesh beneath the epidermis will be white.

If nemas are present, the basal area will be characteristically softer and the flesh of the bulb will have a brownish tinge. Cutting these bulbs from tip to bottom will show the brown streaks penetrating upwards into the bulb. See Section II for further information.

Fusarium sp. - Imperfect Fungus
See Section III

*Urocystis colchici - Basidiomycete

This organism, the cause of the smut disease of Colchicum and Bulbocodium, is characterized by the presence of blister-like smut sori on the outer tunic. When broken, a dry, powdery black mass of smut spores is revealed. This disease may easily be detected by external examination.

*Uromyces colchici - Basidiomycete

This fungus, affecting both Colchicum and Bulbocodium, causes a rust disease. Detection of the disease is extremely difficult since the sori can be found only on the inside of the outer tunic. Weakened or brittle spots on this tunic may sometimes indicate the presence of the rust sori beneath.

*Hepialus sp. - Lepidoptera

This insect has been intercepted in these bulbs according to PC records.

Convallaria:

*Aphelenchoides blastophthorus - Nematode

*Aphelenchoides sp. - Nematode

*Ditylenchus convallariae - Nematode

*Pratylenchus convallariae - Nematode

See Section II

Sclerotium nigricans - Imperfect Fungus

See Section III

Eremurus:

*Aphelenchoides ritzema-bosi - Nematode

See Section II

Fritillaria:

*Aphelenchoides sp. - Nematode

See Section II

Sclerotinia bulborum - Ascomycete

See Section III

Galtonia:

*Ditylenchus dipsaci - Nematode

See Section II

Fusarium sp. - Imperfect Fungus

Penicillium sp. - Imperfect Fungus

See Section III

Hemerocallis:

*Apion rufus - Coleoptera

This weevil may sometimes be found infesting these bulbs.

Hyacinthus:

*Ditylenchus dipsaci - Nematode

*Aphelenchoides subtenuis - Nematode
See Section II

Aspergillus niger - Imperfect Fungus
See Section III

Erwinia carotovora - Bacterium

This common bacterial soft rot organism causes a condition in the bulbs referred to as "white slime" or "snot." Early symptoms may be revealed by cutting off the tips of the bulb to reveal the scales. A noticeable bright yellow, watery breakdown usually involving the central bulb scales indicates this disease. As the disease progresses, the bulb will completely break down and exude a clear, white, sticky liquid having a characteristic odor.

Penicillium spp. - Imperfect Fungus

Sclerotium bulborum - Imperfect Fungus
See Section III

*Xanthomonas hyacinthi - Bacterium

When the tip or base of the bulb is cut through, a dull yellow appearance of the scales would indicate a diseased condition. The outer scales tend to be more involved than those close to the core. Symptoms may be present at either end or all through the bulb.

Some varieties have a greater susceptibility than others. In the Netherlands this disease, commonly called "hyacinth yellows," has been nearly eradicated through variety and stock selection.

Bulb Flies - Diptera
See Section IV

Lilium:

*Aphelenchoides fragariae - Nematode

*Aphelenchoides ritzema-bosi - Nematode

The most helpful symptom for determinating infestations in these bulbs is the relaxation or loose arrangement of the bulb scales about the new growing tip. In healthy bulbs these scales fit tightly together. Other signs such as discoloration or decomposition may be present. See also Section II.

Botrytis elliptica - Imperfect Fungus

This organism, usually affecting the above ground parts of the plant, may occasionally cause decay of the bulb. If present, sclerotia may generally be found. See Section III for further information.

*Colletotrichum lilii - Imperfect Fungus

A pathogenic disease of lily bulbs known as "black scale" is caused by this fungus. It is recognized by the presence of fruiting bodies (acervuli) associated with the necrotic condition of the black and shrunken bulb scales.

This organism should not be confused with Colletotrichum liliacearum, a saprophytic fungus associated with dead plant material.

Cylindrocarpon radicicola - Imperfect Fungus

Fusarium sp. - Imperfect Fungus

Penicillium sp. - Imperfect Fungus

See Section III

*Frankliniella liliivora - Thysanoptera

See Section IV (Thrips)

*Hepialus sp. - Lepidoptera

Records show this insect as being intercepted in its larval stage on these bulbs.

*Lilioceris lilii - Coleoptera

An insect of the family Chrysomelidae that has been intercepted quite often on these bulbs, primarily from the European area.

*Liothrips vaneecki - Thysanoptera

See Section IV (Thrips)

Muscari:

*Ditylenchus dipsaci - Nematode

See Section II

Botrytis galanthina - Imperfect Fungus

Corynebacterium fasciens - Bacterium

Penicillium sp. - Imperfect Fungus

Sclerotinia bulborum - Ascomycete

Sclerotium tuliparum - Imperfect Fungus

See Section III

Aphids - Homoptera
See Section IV

Bulb Flies - Diptera
See Section IV

Ornithogalum:

*Ditylenchus dipsaci - Nematode
*Meloidogyne sp. - Nematode
See Section II

Fusarium sp. - Imperfect Fungus
Penicillium sp. - Imperfect Fungus
Sclerotinia bulborum - Ascomycete
See Section III

*Aceria tulipae - Mite
See Section V

Puschkinia:

*Ditylenchus dipsaci - Nematode
See Section II

Sclerotinia bulborum - Ascomycete
See Section III

Scilla:

*Aphelenchoides sp. - Nematode
*Ditylenchus dipsaci - Nematode
*Meloidogyne sp. - Nematode
See Section II

Fusarium sp. - Imperfect Fungus
Penicillium sp. - Imperfect Fungus
Sclerotinia bulborum - Ascomycete
Sclerotium sp. - Imperfect Fungus
See Section III

Aphids - Homoptera

*Brachycerus sp. - Coleoptera
The larvae of this weevil have been found
feeding in these bulbs according to PQ records.

Bulb Flies - Diptera
See Section IV

Mealybugs - Homoptera
See Section IV

Tulipa:

*Ditylenchus destructor - Nematode

*Ditylenchus dipsaci - Nematode

Symptoms can not be observed without first removing or prying under the outer shell or tunic. The two species of nematodes can usually be segregated by bulb symptoms. D. destructor tends to keep within certain lines or streaks radiating from the basal plate, while D. dipsaci may spread more widely causing discoloration to a larger area of the bulb surface.

Tulipa praestans fusilier and those other varieties having a hard outer "shell" seem to have more susceptibility than others. For further information see Section II

Botrytis tulipae - Imperfect Fungus

Fusarium oxysporum f. tulipae - Imperfect Fungus

Penicillium sp. - Imperfect Fungus

Sclerotinia bulborum - Ascomycete

Sclerotium tuliparum - Imperfect Fungus

See Section III

Cucumber Mosaic - Virus

Dark circular necrotic rings in the fleshy scale are symptoms of this disease.

Chalking

A condition where the bulb becomes hard and chalky. It is believed to be a physiological disorder.

Gummosis

A physiological disorder usually manifested as a gum exudation, which hardens on the bulb. When this occurs at the tip of the bulb, the flowering ability of the bulb may be affected. The variety Red Emperor is particularly susceptible.

Aphids - Homoptera

See Section IV

Bulb Flies - Diptera

See Section IV

*Aceria tulipae - Mite

See Section V

Orchidaceae

Bletilla:*Aphelenchoides fragariae - Nematode*Meloidogyne sp. - Nematode

See Section II

Oxalidaceae

Oxalis:*Aphelenchoides fragariae - Nematode

See Section II

Fusarium sp. - Imperfect Fungus

See Section III

Primulaceae

Cyclamen:*Aphelenchoides sp. - Nematode*Meloidogyne sp. - Nematode

See Section II

Cylindrocarpon radicicola - Imperfect FungusErwinia spp. - Bacterium

See Section III

Phoma sp. - Imperfect Fungus

Necrotic areas with the presence of fruiting bodies (pycnidia) would indicate infection by this fungus.

Thielaviopsis basicola - Imperfect Fungus

See Section III

*Spp. of Curculionidae - Coleoptera

Records show several interceptions of different genera associated with these bulbs. Both larvae and adults may be found usually feeding or pupating the bulb.

*Tarsonemid Mites

See Section V

Ranunculaceae

Note: Several genera in this family including Anemone, Hranthis, and Ranunculus, when cured properly, will be dried out and shriveled so as to almost appear dead. When improperly cured, a more moist condition invites decay from secondary organisms.

Anemone:

*Meloidogyne sp. - Nematode
See Section II

Penicillium sp. - Imperfect Fungus
Sclerotinia tuberosa - Ascomycete
See Section III

Eranthis:

Fusarium sp. - Imperfect Fungus
See Section III

Paeonia:

*Aphelenchoides fragariae - Nematode
*Meloidogyne sp. - Nematode
See Section II

Botrytis paeoniae - Imperfect Fungus
See Section III

Sclerotiopsis concava - Imperfect Fungus
Tiny black, slightly concave sclerotia dotting
old stems indicate this fungus.

Thielaviopsis basicola - Imperfect Fungus
See Section III

Ranunculus:

*Meloidogyne sp. - Nematode
See Section II

Zingiberaceae

Kaempferia:

*Meloidogyne sp. - Nematode
See Section II

SECTION VII

List of Bulbs by Genera, Family, and
Common Name

The following is a listing of bulbs conforming to the specifications of regulation 3. The genera of bulbs with the family designation in brackets as well as a list of accepted common names are included. The list of common names is indented from the generic list.

Family names in the list are abbreviated and refer to the following: (Amar.) Amaryllidaceae; (Ar.) Araceae; (Begon.) Begoniaceae; (Berber) Berberidae; (Bignon.) Bignoniaceae; (Borag.) Boraginaceae; (Campan.) Campanulaceae; (Cann.) Cannaceae; (Compos.) Compositae; (Fumar.) Fumariaceae; (Geran.) Geraniaceae; (Gesner.) Gesneriaceae; (Irid.) Iridaceae; (Lil.) Liliaceae; (Orch.) Orchidaceae; (Oxal.) Oxalidaceae; (Papaver.) Papaveraceae; (Prim.) Primulaceae; (Ranun.) Ranunculaceae; (Sax.) Saxifragaceae; (Trop.) Tropaeolaceae; (Zingiber.) Zingiberaceae.

Achimenes (Gesner.)
 Acidanthera (Irid.) Gladixia
 Adders Tongue - Erythronium
 African Lily - Agapanthus
 Agapanthus (Lil.) - Lily of the Nile, African Lily
 Albuca (Lil.)
 Allium (Lil.) - Onion
 Alp Lily - Lloydia
 Alstroemeria (Amar.) - Peruvian Lily, Chilean Lily
 Anacrerinum same as Crinodonna
 Amaryllis (Amar.)
 Amazon Lily - Eucharis
 Amianthium (Lil.) Crowpoison
 Ammocharis (Amar.) Sand Nymph
 Anapalina (Irid.)
 Androcymbium (Lil.)
 Androstephium (Lil.)
 Anemone (Ranun.) Windflower, Pulsatilla - Prohibited entry from Germany
 Anomatheca same as Lapeirousia
 Anthericum (Lil.) Paradisea, St. Bruno Lily, St. Bernard Lily
 Antholyza (Irid.)
 Arum (Ar.)
 Aztec Lily - Sprekelia
 Babiana (Irid.) Baboonroot
 Baboonroot - Babiana
 Begonia (Begon.)
 Bellevalia same as Hyacinthus
 Bengal Lily - Crinum
 Bermuda Buttercup - Oxalis cernua
 Bossera (Lil.) Coraldrops
 Bleeding Heart - Dicentra
 Bletia (Orch.) same as Bletilla
 Bletilla (Orch.) Bletia
 Blood Lily - Haemanthus
 Bloomeria (Lil.)
 Bluebells - Mertensia
 Bongardia chrysogonium (Berber.)
 Boophane (Amar.) Cowbane Lily
 Bottionea (Lil.)
 Bowiea (Lil.)
 Bravoa (Amar.) Mexican Twinbloom
 Brodiaea (Lil.)
 Brunsdonna (Amar.)
 Brunsvigia (Amar.)
 Bugle Lily - Watsonia
 Bulbocodium (Lil.) Spring Meadow-Saffron
 Euphane same as Boophane
 Buttercup - Ranunculus
 Caladium

Calla same as Zantedeschia
Caliphurria (Amar.)
Calochortus (Lil.) - Mariposa Lily, Mariposa Tulip, Star Tulip,
Globe Tulip
Calostemma (Amar.)
Camassia - (Lil.) Camass
Camass - Camassia
Canna (Cann.)
Cape Cowslip - Fachenalia
Chasmanthe (Irid.)
Checkered Lily - Fritillaria meleagris
Chionodoxa (Lil.) Glory of the Snow
Chionoscilla (Lil.)
Chile Star - Leucocoryne
Chilean Lily-Alstroemeria
Chincherinchee - Ornithogalum thyrsoides
Chlidanthus (Amar.) - Delicate lily
Chorogalum (Lil.)
Cipura (Irid.)
Clivia (Lil.) Kafir lily (common name used also for Schizostylis)
Colchicum (Lil.) Meadow Saffron
Convallaria (Lil.) Lily of the Valley
Cooperanthes (Amar.)
Cooperia (Amar.) Rain Lily, Prairie Lily
Coppertip - Crocosmia
Coral drops - Bessera
Corn Lily - Ixia
Corydalis (Fumar.)
Cowbane Lily - Boophane
Crimson Flag - Schizostylis
Cruciflora (Amar.)
Crinum (Amar.) - Bengal Lily, Milk and Wine Lily
Crocosmia (Irid.) Coppertip
Crocus (Irid.)
Crown Imperial - Fritillaria imperialis
Crow poison - Amianthium
Curcuma (Zingiber.)
Curtonus (Irid.)
Cyclamen (Prim.)
Cyclobothra same as Calochortus
Cypella (Irid.)
Cyrtanthus (Amar.)
Daffodil - Narcissus
Dahlia (Compos.)
Day Lily - Hemerocallis
Deathcamas - Zigadenus
Delicate Lily - Chlidanthus
Desert Candle - Fremurus
Desert Lily - Hesperocallis

Dicentra (Fumar.) Bleeding Heart
 Dielytra same as Dicentra
 Dierama - (Irid.) Elfin Wands
 Dipcadi (Lil.)
 Dipidax (Lil.)
 Dogstooth Violet - Erythronium
 Drimia (Lil.)
 Drymophila (Lil.)
 Elfin Wands - Dierama
 Elisena (Amar.)
 Eranthis (Ranun.) - Winter Aconite
 Eremurus (Lil.) Foxtail Lily, Desert Candle
 Erythronium (Lil.) - Dogstooth Violet, Trout Lily, Fawn Lily,
 Adders Tongue
 Eucharis (Amar.) Amazon Lily
 Eucomis (Lil.) Pineapple Flower
 Eurycles (Amar.)
 Eustephia (Amar.)
 Eustylis (Irid.)
 False Garlic - Nothoscordum
 False Freesia - Lapeirousia
 Fall Daffodil - Sternbergia lutea
 Fawn Lily - Erythronium
 Ferraria (Irid.)
 Flame Lily - Pyrolirion
 Floral Firecracker - Brevoortia
 Foxtail Lily - Eremurus
 Freesia (Irid.)
 Fritillaria (Lil.) - Fritillary, Crown Imperial (imperialis)
 Checkered Lily (meleagris)
 Guinea Hen Flower (meleagris)
 Fritillary - Fritillaria
 Funkia - Hosta
 Gagea (Lil.)
 Galanthus (Amar.) Snowdrops
 Galtonia (Lil.) (Hyacinthus) Giant Summer Hyacinth
 Gayfeather - Liatris
 Geissorhiza (Irid.)
 Geranium tuberosum (Geran.)
 Gesneria (Gesner.)
 Giantbell - Ostrowskia magnifica
 Giant Summer Hyacinth - Galtonia (Hyacinthus) candicans
 Ginger - Zingiber
 Gingerlily - Hedychium
 Gladiolus (Irid.) Prohibited entry from Africa
 Gladixia - Acidanthera
 Globba (Zingiber.)
 Globe Tulip - Calochortus
 Gloriosa (Lil.) Glory Lily
 Glory Lily - Gloriosa
 Glory of the Snow - Chionodoxa

- Gloxinia same as Sinningia
 Goldstar Grass - Hypoxis
 Grape Hyacinth - Muscari
 Griffinia (Amar.)
 Guernsey Lily - Nerine
 Guinea Hen Flower - Fritillaria meleagris
 Habenaria radiata (Orch.)
 Habranthus (Amar.)
 Haemanthus (Amar.) Blood Lily
 Hardy Gloxinia - Incarvillea
 Harlequin Flower - Sparaxis
 Hastingsia (Lil.)
 Hedychium (Zingiber.)
 Helonias (Lil.) Swamppink
 Heloniopsis (Lil.)
 Hemerocallis (Lil.) Daylily
 Herbertia (Irid.)
 Hermodactylus (Irid.) "Iris" tuberosa, Widow's Iris, Snake's
 Head Iris
 Hesperantha (Irid.)
 Hesperocallis (Lil.) Desert Lily
 Hessea (Amar.)
 Hexaglottis (Irid.)
 Hippeastrum (Amar.)
 Homeria (Irid.)
 Homoglossum (Irid.)
 Hosta (Lil.) Funkia, Niobe, Plantainlily
 Hyacinth - Hyacinthus
 Hyacinthus (Lil.) Hyacinth (see also Galtonia)
 Hyalis - Ixia
 Hydrotaenia (Irid.)
 Hyline (Amar.)
 Hymenocallis (Amar.) Sometimes used synonymously with Ismene, separate
 in Standardized Plant Names. Improperly called
 Spiderlily
 Hypoxis (Amar.) Goldstar Grass
 Incarvillea (Bignon.) Hardy Gloxinia
 Ipheion (Lil.)
 Iris (Irid.)
 "Iris" tuberosa - Hermodactylus (tuberosa)
 Ismene (Amar.) Peruvian Daffodil. Sometimes used synonymously with
 Hymenocallis, separate in Standardized Plant Names
 Isoloma (Gesner.)
 Ixia (Irid.) Corn Lily, Hyalis
 Ixiolirion (Amar.) - Siberian Bluebell
 Jacobean Lily - Sprekelia
 Jonquil - Narcissus
 Kaempferia (Zingiber.)
 Kafir Lily - Clivia or also used for Schizostylis

Kohleria (Gesner.)
 Lachenalia (Lil.) Cape Cowslip
 Lapeirousia (Irid.) False Freesia
 Lebanon Squill - Puschkinia
 Leucocoryne (Lil.) Chile Star
 Leucojum (Amar.) Snowflake
 Liatris (Compos.) Gayfeather - has been removed from list subject
 to regulations of 319.37-3. Now subject to
 319.37-6. Material must be sent to inspection
 house for inspection and further handling.
 Lilium (Lil.) Lily
 Lily - Lilium
 Lily of the Nile - Agapanthus
 Lily of the Valley - Convallaria

 Littonia (Lil.)
 Lizard Arum - Sauromatum
 Lloydia (Lil.) Alp Lily
 Lycoris (Amar.) Magic Lily, Spiderlily (L. radiata)
 Magic Lily - Lycoris
 Manfreda (Amar.)
 Mariposa Lily - Calochortus
 Mariposa Tulip - Calochortus
 Massonia (Lil.)
 Meadow Saffron - Colchicum
 Meadow Saxifrage - Saxifraga granulata
 Melasphaerula (Irid.)
 Merendera (Lil.)
 Mertensia (Borag.) Bluebells
 Mexican Star - Milla
 Mexican Tiger Flower - Tigridia
 Mexican Twinbloom - Bravoa
 Milk and Wine Lily - Crinum
 Milla (Lil.) Mexican Star
 Montbretia same as Tritonia
 Moraea (Irid.)
 Muilla (Lil.)
 Muscari (Lil.) Grape Hyacinth
 Naegelia (Gesner.)
 Narcissus (Amar.) Daffodil, Jonquil, Paperwhite, Soleil D'Or
 Nemastylis (Irid.)
 Nerine (Amar.) - Guernsey Lily
 Niobe - Hosta
 Nomocharis (Lil.)
 Notholirion (Lil.)
 Nothoscordum (Lil.) False Garlic
 Onion - Allium
 Ornithagalum (Lil.) Chinchierinchee, Star of Bethlehem
 Ostrowskia magnifica (Campan.) Giantbell
 Oxalis (Oxal.) Bermuda Buttercup (O. cernua)
 Paeonia (Ranun) Peony (herbaceous)
 Pamianthe (Amar.)

Pancratium (Amar.)
 Papaver (Papaver.) Poppy
 Paperwhite - Narcissus
 Paradisea - Anthericum
 Pasithea (Lil.)
 Peony - Paeonia
 Peruvian Daffodil - Ismene
 Peruvian Lily - Alstroemeria
 Phaedranassa (Amar.) Queenlily
 Pineappleflower - Eucomis
 Pitcherlily - Urceolina
 Placea (Amar.)
 Plantainlily - Hosta
 Polianthes (Amer.) Tuberose
 Polyanthes same as Polianthes
 Polyanthus same as Polianthes
 Poppy - Papaver
 Prairie Lily - Cooperia
 Prochnyanthes (Amar.)
 Pulsatilla same as Anemone (Prohibited entry from Germany)
 Puschkinia (Lil.) Lebanon Squill, Striped Squill
 Pyrolirion (Amar.) Flamelily
 Quamasia same as Camassia
 Queenlily - Phaedranassa
 Rain Lily - Cooperia
 Ranunculus (Ranun.) Buttercup
 Rechsteineria (Gesner.)
 Resurrectionlily - Kaempferia
 Rhodohypoxis (Amar.)
 Rigidella (Irid.)
 Romulea (Irid.)
 Salpingostylis (Irid.)
 Sandersonia (Lil.)
 Sandnymph - Ammocharis
 Sauromatum (Ar.) Lizard Arum
 Saxifraga granulata (Sax.)
 Saxifraga peltata (Sax.)
 Seaonion - Urgina
 Scarborough Lily - Vallota
 Schizobasopsis same as Bowiea
 Schizostylis (Irid.) Crimson Flag, Kafir lily (latter name used
 also for Clivia)
 Scilla (Lil.) S. siberica - Squill, S. campanulata - Spanish
 Bluebells - Siberian Bluebell - Ixiolirion
 Sinningia - The "Gloxinia" of florists (Gesner.)
 Smithiantha (Gesner.)
 Snake's Head Iris - Hermodactylus
 Snowdrops - Galanthus

Snowflake - *Leucojum*
 Soleil D'Or - *Narcissus* (Paperwhite)
 Sparaxis (Irid.) Harlequin Flower, Wand Flower
 Spanish Bluebells - *Scilla campanulata*
 Spiderlily - Used for two genera:
 Lycoris radiata
 Hymenocallis (Not a recognized common
 name for this Genus)
 Spiloxene (Amar.)
 Sprekelia (Amar.) Aztec Lily, Jacobean Lily, St. James Lily
 Spring Meadow Saffron - *Bulbocodium*
 Squills - *Scilla siberica*
 Star of Bethlehem - *Ornithogalum*
 Star Tulip - *Calochortus*
 St. Bernard Lily - *Anthericum*
 St. Bruno Lily - *Anthericum*
 Stenanthium (Lil.)
 Stenomesson (Amar.)
 Sternbergia (Amar.) *S. lutea* - Fall Daffodil
 St. James Lily - *Sprekelia*
 Streptanthera (Irid.)
 Striped Squill - *Puschkinia*
 Summer Hyacinth - *Galtonia* (*Hyacinthus*) *candicans*
 Swamppink - *Helonias*
 Synnotia (Irid.)
 Tecophilaea (Amar.)
 Thomsonia (Ar.)
 Tiger Flower - *Tigridia*
 Tigridia (Irid.) Tiger Flower, Mexican Tiger Flower
 Trimeza (Irid.)
 Tristagma (Lil.)
 Tritoleia same as *Brodiaea*
 Tritonia (Irid.) *Montbretia*
 Tropaeolum tuberosum (Trop.)
 Trout Lily - *Erythronium*
 Tuber Nasturtium - *Tropaeolum tuberosum*
 Tuberose - *Polianthes*
 Tulbaghia (Lil.)
 Tulip (Lil.) Tulip
 Tulip - *Tulipa*
 Tydaea (Gesner.)
 Urceocharis (Amar.)
 Urceolina (Amar.) Pitcherlily
 Urginea (Lil.) Seaonion
 Vagaria (Amar.)
 Vallota (Amar.) Scarborough Lily
 Veltheimia (Lil.)
 Wandflower - *Sparaxis*

Watsonia (Irid.) Bugle Lily
Widow's Iris - Hermodactylus
Windflower - Anemone
Zantedeschia (Ar.) Calla, Callalily
Zephyranthes (Amar.) Zephyr Lily
Zephyr Lily - Zephyranthes
Zigadenus (Lil.) Deathcamas
Zingiber (Zingiber.) Ginger
Zygadenus same as Zigadenus

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